

# COM SCI 118 Computer Network Fundamentals

## Project 2: Simple Window-based Reliable Data Transfer in C/C++ Fall 2015

### 1 Goal

The purpose of this project is to use UDP Socket and C/C++ programming language to implement a reliable data transfer protocol.

### 2 Instructions

In this project, you are asked to realize reliable data transfer on top of UDP. You can implement either Selective Repeat protocol or Go-Back-N protocol. Stop-wait and stop-forward protocols are NOT allowed in this project.

Note that your programs will act as both a network application (file transfer program) and a reliable transport layer protocol built over the unreliable UDP transport layer. That is, you need to write one program for the server, and another one for the client. The receiver program would request a file from the sender, and the sender would be able to reply the file. The receiver program will take the hostname and port number of the sender, and the name of a file it wants to retrieve from the sender as a command line arguments. For example:

To run the sender type: *shell > sender < portnumber >*

To run the receiver type: *shell > receiver < sender\_hostname >< sender\_portnumber >< filename >*

The receiver will first send a message to the sender which includes the name of the file requested. If the file exists, the sender will divide the entire file into multiple packets (the maximum packet size is 1K bytes), and then add some header information to each packet before sending them to the receiver. It is up to you what information you want to include in the header (e.g. Source, Destination port etc...), but at least your header should include information for reliable data delivery. You are free to define what kind of messages you will require, and the format of the messages. You can create a large file being requested on your own, but make sure the file is transmitted in multiple packets.

Only C/C++ are allowed in this project.

### 3 Emulate Packet Loss/Corruption

Although using UDP does not ensure reliability of data transfer, the actual rate of packet loss or corruption in LAN may be too low to test your program. Therefore you should simulate packet loss and corruption in the following manner:

- Packet loss: With probability  $P_l$  ignore arriving packets (pretend not receiving the arriving packets).
- Packet corruption: With probability  $P_C$  mark an arriving packet as being corrupted (pretend the arriving packets are corrupted).
- $P_l$  and  $P_C$  range between 0 and an appropriate value (say, 0.40). Note both data packets traveling from sender to receiver and acknowledgement packets traveling from receiver to sender may be lost or corrupted.

## 4 Hints

The best way to approach this project is in incremental steps. Here is our suggestion: first, assume there is no packet loss or corruption. Just have the sender send a packet, the receiver respond with an ACK, and so on. Secondly, introduce corruption. This means you must implement some retransmission functionality. Thirdly, introduce packet loss. Now you have to add a timer at the sender side for each packet.

The credit of your project is distributed among the required functions. If you only finish part of the requirements, we still give you partial credit. So please do the project incrementally.

To demonstrate your programs, you can make the window size  $CW_{nd}$ , the packet loss probability  $P_l$ , the packet corruption probability  $P_C$ , as input parameters when you first run your server and client programs.

For example, to run the sender side: `> sender < portnumber > CW_{nd} P_l P_C`

and to run the receiver side: `> receiver < sender_hostname > < sender_portnumber > < filename > P_l P_C`

You should print messages to the screen when the server or the client is sending or receiving packets. Your message should include information such as whether it is a DATA packet or an ACK, the sequence number, whether it is corrupted or lost etc. Such messages will be helpful for you to debug the programs, and we can use them to examine the correctness of your programs.

## 5 Due Time and Demo

1. You should demo your program to the TA with whom you are enrolled. The demo dates will be annouced later.
2. Submit an electronic copy of the project on CCLE by 11:55:00pm Thursday(03 December). This is **HARD DEADLINE**

### 5.1 Demo

In the demo, a VM machine is provided for testing, which is the same as that in Project 1. You need to compile your programs, and run your programs to deliver a test file from the sender side to the receiver side. To show the delivery process on the screen, your program should print out all the necessary operations. We may ask you to use different values for  $P_l$  and  $P_C$  to test your programs. We will ask you to compare the received test files with the original one using the `diff` command.

#### Demo Procedure:

1. Sign up for Demo : TA will distribute the signup sheet in the discussion section of the 7th and 8th week.
2. In Demo : You need to prepare 3 slides to present. 1 slide for design and implementation, 1 slide for experiences you gain, 1 slide for lesson learnt from project and suggestion to project.
  - TA will ask you to demo the function step by step
  - TA will also ask you questions during demo, you need to answer the question clearly. All question will related to your project implementation.
3. You have 10 minutes to demo your protocol. Only the code you have submitted would be used in this demo.

## 6 Project Submission

1. Put all your files into a directory, must called `project2.UID.tar`. UID is the student id of one of the students of the group.
2. Submit the file `project2.UID.tar` via SEAS online submission in course webpage.
3. The `project2.UID.tar` should contain the following files

- Source codes (can be multiple files)
  - A report file (.doc or .pdf) no more than 3 pages. The report will contain:
    - Student names and Student IDs at the very beginning (2 students per-group).
    - Implementation description (header format, messages, timeouts, window-based protocol etc).
    - Difficulties that you faced and how you solved them.
  - Makefile
4. The TAs will only type “make” to compile your code, make sure your Makefile works in the provided VM machine.
  5. Each group just needs to submit one set of files.